COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mechanics of body fluids and bioflows [S2IBio1>MPUiB]

Course

Field of study
Biomedical Engineering

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, mathematics and mechanics; skills of logical thinking; association of knowledge of many branches; getting and using information form library and internet; social expertise: needs of continuous learnig, getting new knowledge

Course objective

Getting knowledge about fluid mechanics (including dynamics) with special treatment for biofluids and dynamics od such fluids

Course-related learning outcomes

Knowledge:
1. Student has extended knowledge of mathematics, physics, chemistry and fluid mechanics necessary in biomedical engineering and useful for formulating and solving complex tasks related to biomedical engineering [K2_W01].

Skills:
1. Student can obtain information from literature, databeses and othe properly selected sources (also in

English or another foreign laguage) in the area of biomedical engineedring, an integrate, interpret and critically assess obtaiined information as well as draw conclusions, formulate and justyfy opinions [K2_U01].
2. Student can specidy paths for further study and learn independently [K2_U05].
3. Student can plan and carry out experiments, can perform computer modelling and simulations in biomedical engineering [K2_U09].
4. Student can evaluate the usefulness of methods and tools applied to solve n engineering task typical of biomedical engineering and observe their limitations, can - using conceptually new methods - perform complex engineering tasks typical of biomedical engineering, including non-typical and research based tasks [K2_U22].
5. Student can - in accordance with the established specification and taking into account non-technical aspects - design a complex process, material, device; can execute the design - at least in part - making use of appropriate methods, techniques andtools while adjusting for this purpose the existing solutions or developing new ones [K2_U23].

Social competences:
1. Student understands the need for lifelong learning; can inspire and organize the learning process of others [K2_K01].
2. Student is aware of the validity and understanding of non-technical aspects and results of engineering activity, including its impact on the environment and related responsibility for decisions taken [K2_K02].
3. Student can cooperate and work in a group, adopting various roles [K2_K03].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture:
Written test of 5 general questions (positive note for minimu 3 correct answers: <3 - ndst, 3 - dst, 3,5 - dst+, 4 - db, 4,5 - db+, 5 - bdb) done at theend of semester.
Laboratorium:
Written test of 5 excerises of subjects realised during semester (positive note for minimu 3 correct answers: <3 - ndst, 3 - dst, 3,5 - dst+, 4 - db, 4,5 - db+, 5 - bdb) done at theend of semester.

Programme content

Lecture:
1. Physiological pressure (definition, used units, values of common quantities). Measurement of pressure.
2. Physical quantities and laws (flow intensity, viscosity, blood vessel resistance, total blood vessel resitance, etastic strin, Archimedes Law, Pascal Law, Laplace Law, continuity law, Barnoulli Law, Poiseuiell Law) related to biofluids.
3. Blood as biofluid. Physical parameters of blood (viscosity, volume, pressure) and vessels (dimater, thickness, length, pressure, volume). Changes of pressure in organism. Calculations of blood vessels resistance. Modelling of fluid flow inblood vessels. Osmotic pressure in capillary. Heart as a pomp, word, power).
4. Transportation of gases in resiratory system. Physical paramters of resiratory system elements (diameter, length, cross-section, volume); vulnerability, resistance.
Laboratorium:
1. Fluid paramters (viscosity, massdesity, compressibility).
2. Physilogical pressure, basic values. Calculation of pressure.
3. Flow intensity, Bernoulli Law for biofluids.
4. Physical parameters of blood and blod vesels - flow in vessels.
5. Particles sedimentaton in fluid - blood test.
6. Physical paramters of resiratory system elements; air flow.

Course topics

none

Teaching methods

Lecture:
Multimedia presentation (images, graphs, videos, simulations)
Laboratorium:
Numerical experiment - computer simulations; Presentation of obtained results; practical work of students - preparing of computer programs to perform simulation; discussion;

Bibliography

Basic
1. R. Gryboś, Podstawy mechaniki płynów, Wydawnictwo Naukowe PWN, Warszawa 1998
2. Y.C. Fung, S. Chien, Introduction to bioengineering, World Scientific, London 2001
Additional
1. M. Cerrolaza, M. Doblare, G Martinez, B. Calvo, Computational bioengineering: current trends and applications, Imperial College Press, London 2004

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00